

EXHIBIT F

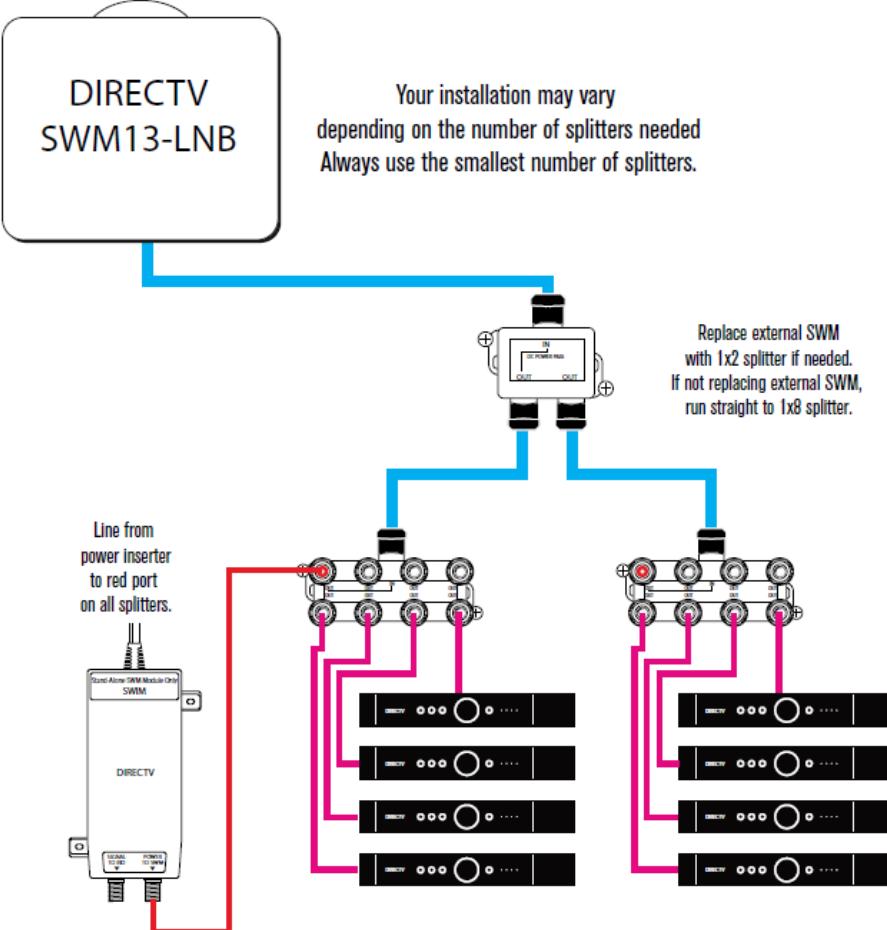
U.S. Patent No. 7,889,759 (“the ’759 Patent”) Exemplary Infringement Chart

The Accused MoCA Instrumentalities are instrumentalities that DirecTV deploys to provide a whole-premises DVR network over an on-premises coaxial cable network, with devices operating with data connections compliant with MoCA 1.0, 1.1, and/or 2.0. The Accused MoCA Instrumentalities include the DirecTV HR24, DirecTV HR34, DirecTV HR44, DirecTV HR54, DirecTV HS17, DirecTV C31, DirecTV C41, DirecTV C51, DirecTV C61, DirecTV C61K and substantially similar instrumentalities. DirecTV literally and/or under the doctrine of equivalents infringes the claims of the ’759 Patent under 35 U.S.C. § 271(a) by using the Accused MoCA Instrumentalities.

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2. A method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network (“BCN”), the method comprising:	<p>The Accused Services are provided using at least the Accused MoCA Instrumentalities including gateway devices (including, but not limited to, the DirecTV HR24, DirecTV HR34, DirecTV HR44, DirecTV HR54, DirecTV HS17, and devices that operate in a similar manner) and client devices (including, but not limited to, the DirecTV C31, DirecTV C41, DirecTV C51, DirecTV C61, DirecTV C61K, and devices that operate in a similar manner), and substantially similar instrumentalities. The Accused MoCA Instrumentalities operate to perform method for determining a common bit-loading modulation scheme for communicating between a plurality of nodes in a broadband cable network (“BCN”) as described below.</p> <p>The DirecTV full-premises DVR network constitutes a broadband cable network as claimed. The DirecTV full-premises DVR network is a MoCA network created between gateway devices and client devices using the on-premises coaxial cable network. This MoCA network is compliant with MoCA 1.0, 1.1, and/or 2.0.</p>

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	<p>“The MoCA system network model creates a coax network which supports communications between a convergence layer in one MoCA node to the corresponding convergence layer in another MoCA node.” (MoCA 1.0, Section 1. See also MoCA 1.1, Section 1.1; MoCA 2.0, Section 1.2.2)</p> <p>“The MoCA Network transmits high speed multimedia data over the in-home coaxial cable infrastructure.” (MoCA 1.0, Section 2. See also MoCA 1.1, Section 2; MoCA 2.0, Section 5)</p> <p>“Broadcast Bit Loading (BBL) – This transmission format is used by each node when transmitting simultaneously to all nodes in the network. The transmission format is derived by each transmitting node to be the common set of transmission parameters based on unicast transmission format from the transmitting node to each other node in the network.” (MoCA 1.0, Section 1.2. <i>See also</i> MoCA 1.1, Section 1.2, MoCA 2.0, Section 3)</p> <p>“In addition to the point-to-point communication, the MoCA protocol supports broadcast and multicast capabilities. When transmitting to multiple devices, a node must find a set of PHY parameters that all the other nodes can receive. Even though two links from a given transmitter may have the same channel capacity, their individual link characteristics may be drastically different. A common set of PHY parameters that both receive nodes can receive may have less capacity. For broadcast and multicast transmissions, a node must calculate a Broadcast Bitloading (BBL) profile for all nodes that may receive the packet from this node. A single MoCA Network must support communications of 2 to 8 MoCA nodes.</p>

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	<p>Each MoCA node must support point-to-point and broadcast modulation profiles with all other MoCA nodes.”</p> <p>(MoCA 1.0, Section 2.1.2. <i>See also</i> MoCA 1.1, Section 2.1.2, MoCA 2.0, Section 5.3.1)</p> <p>DirecTV utilizes the MoCA standard to provide an on-premises DVR network over an on-premises coaxial cable network as shown below:</p>

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	 <p>Your installation may vary depending on the number of splitters needed Always use the smallest number of splitters.</p> <p>Line from power inserter to red port on all splitters.</p> <p>Replace external SWM with 1x2 splitter if needed. If not replacing external SWM, run straight to 1x8 splitter.</p> <p>Total number of tuners cannot exceed 13. Genie = 5 tuners (each Genie Client = 0 tuners) DVR = 2 tuners, receiver = 1 tuner</p>

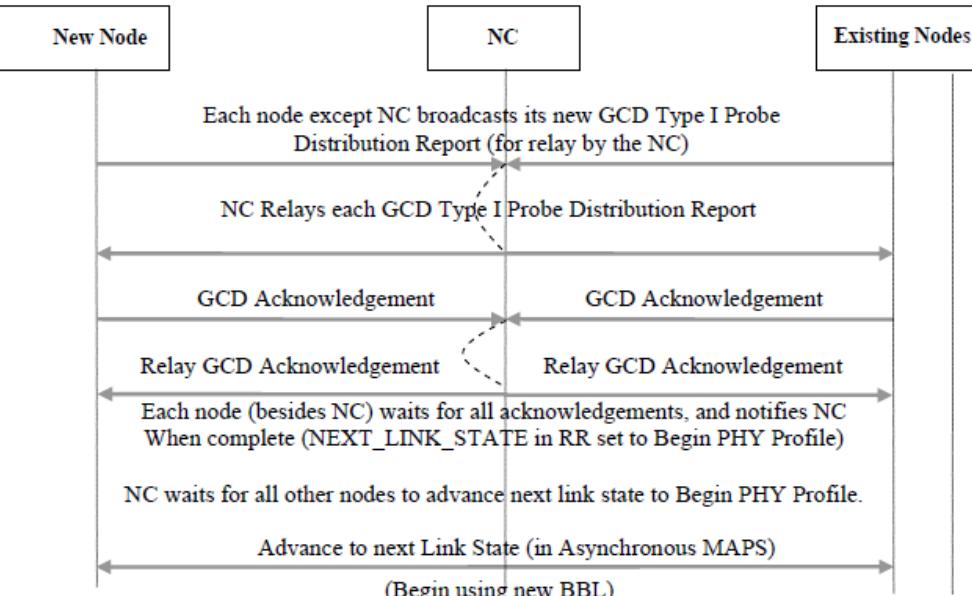
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plurality of receiving nodes within the plurality of nodes;	<p>For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that transmit a probe signal from a transmitting node within the plurality of nodes to a sub-plurality of receiving nodes within the plurality of nodes.</p> <p>“While it is physically a shared medium, the logical network model is a fully meshed collection of point-to-point links, each with its own unique channel characteristics and channel capacity. MoCA devices use optimized PHY parameters between every point to point link. Each set of optimized PHY parameters is called a PHY Profile. Because each link is unique, it is critical that all nodes know the source and the destination for every transmission.” (MoCA 1.0, Section 2.1.2. <i>See also</i> MoCA 1.1, Section 2.1.2; MoCA 2.0, Section 1.2.2)</p> <p>“The topology of the in-home coax typically results in a multi-path delay profile. Because the echoes can be stronger and/or weaker than the original signal, depending on the output port-to-output port isolation of the jumped splitter, the channel is said to have either pre- or post-echoes, respectively. A zero decibel echo, i.e., equal power to the main path, leads to deep nulls in the frequency domain spectrum. In order to achieve target packet error rates of less than 10-5 for large packets (>1500 bytes) with no retransmissions, the MoCA physical layer uses channel pre-equalization (using bit loading) and multi-tone modulation on all links.” (MoCA 1.0, Section 2.2. <i>See also</i> MoCA 1.1, Section 2.2; MoCA 2.0, Section 5.2)</p>

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	<p>“ACMT is a variation of orthogonal frequency division multiplexing (OFDM) where knowledge of the channel is used to pre-equalize all signals using variable bitloading on all subcarriers. The term used to describe the bitloading of the ACMT subcarriers is “modulation profile” and the process of creating a modulation profile between a node pair is called “modulation profiling”. During periodic modulation profiling, probes are sent between all nodes and analyzed. After probe analysis, modulation profiles are chosen to optimize individual link throughput while maintaining a low packet error rate.”</p> <p>(MoCA 1.0, Section 2.2. <i>See also</i> MoCA 1.1, Section 2.2; MoCA 2.0, Section 5)</p> <p>“A variety of physical layer frequency-domain and time-domain probes are used to create modulation profiles, optimize performance, and allow for various calibration mechanisms. Type I Modulation Profile Probes are frequency domain probes used to determine modulation profiles of the channel between any two nodes. Type II Probes are frequency domain probes consisting of two tones that may be used to fine tune performance. A Type III Echo Profile Probe may be used to determine the impulse response of the channel. This information can be used to optimize various physical layer parameters. In addition to the above probes, this specification provides opportunities for various unique Loopback Transmissions which may be useful for RF calibration, among other things.”</p> <p>(MoCA 1.0, Section 2.2. <i>See also</i> MoCA 1.1, Section 2.2; MoCA 2.0, Section 5.2)</p>

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	<pre> graph TD A[Link Control State] --> B[Begin Node Admission State] B --> C[New Node Type I Probe TX state] C --> D[New Node Type I Probe RX state] D --> E[New Node GCD Distribution state] E --> F[Begin PHY Profile state] F --> G[Steady state] B --- S1[Step 1- Admission request/ Admission Response exchange + Type A and B Loopback, and Type I and II Probe transmissions] B --- S2[Step 2 – Optional step for NC to receive Type II Probe] B --- S3[Step 3 – Type I Probe transmissions, Type I Probe reports, BBL exchange and switch to new BBL for asynchronous MAPs] C --- S4[TX Power Information exchanged between NN and EN/NC] C --- S5[NN transmits Type I Probe transmission] C --- S6[NN requests via NC Type I Probe report from EN] C --- S7[NC relays the Type I Probe report request to ENs] C --- S8[EN sends Type I Probe report to NC] C --- S9[NC relays the report to NN] D --- S10[Power information is exchanged between EN and NN] D --- S11[ENs send Type I Probe to NN] D --- S12[EN requests a report (relayed via NC)] D --- S13[NN sends Type I report to transmitting nodes (relayed via NC)] E --- S14[All nodes (except NC) send their GCD descriptor to all other nodes] E --- S15[The receiving node acknowledges the BBL reception] F --- S16[All nodes switch to new BBL + unicast PHY Profile] G --- S17[NN admission is complete] </pre> <p>The flowchart illustrates the steps involved in admitting a node to the network, starting from the Link Control State and progressing through several intermediate states: Begin Node Admission State, New Node Type I Probe TX state, New Node Type I Probe RX state, New Node GCD Distribution state, Begin PHY Profile state, and finally Steady state. Each state is associated with specific processing steps:</p> <ul style="list-style-type: none"> Begin Node Admission State: <ul style="list-style-type: none"> Step 1- Admission request/ Admission Response exchange + Type A and B Loopback, and Type I and II Probe transmissions Step 2 – Optional step for NC to receive Type II Probe Step 3 – Type I Probe transmissions, Type I Probe reports, BBL exchange and switch to new BBL for asynchronous MAPs New Node Type I Probe TX state: <ul style="list-style-type: none"> TX Power Information exchanged between NN and EN/NC NN transmits Type I Probe transmission NN requests via NC Type I Probe report from EN NC relays the Type I Probe report request to ENs EN sends Type I Probe report to NC NC relays the report to NN New Node Type I Probe RX state: <ul style="list-style-type: none"> Power information is exchanged between EN and NN ENs send Type I Probe to NN EN requests a report (relayed via NC) NN sends Type I report to transmitting nodes (relayed via NC) New Node GCD Distribution state: <ul style="list-style-type: none"> All nodes (except NC) send their GCD descriptor to all other nodes The receiving node acknowledges the BBL reception Begin PHY Profile state: <ul style="list-style-type: none"> All nodes switch to new BBL + unicast PHY Profile Steady state: <ul style="list-style-type: none"> NN admission is complete

Figure 3-4. Flowchart of the Steps Involved in Admitting a Node to the Network
(MoCA 1.0, Figure 3-4. See also MoCA 1.1, Figure 3-6; MoCA 2.0, Figure 8-3)

“When an EN receives Type I Probe Report, it MUST begin reporting New

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	<p>Node GCD Distribution state to the NC. The NN MUST begin reporting New Node GCD Distribution state in its reservation requests (byte code 0x04 NEXT_LINK_STATE field) after it sends the Type I Probe Report for all nodes in the network.”</p> <p>(MoCA 1.0, Section 3.6.6. <i>See also</i> MoCA 1.1, Section 3.6.6, MoCA 2.0, Section 8.3.7)</p>  <pre> sequenceDiagram participant NewNode as New Node participant NC as NC participant ExistingNodes as Existing Nodes Note over NewNode,NC,ExistingNodes: Each node except NC broadcasts its new GCD Type I Probe Distribution Report (for relay by the NC) Note over NewNode,NC,ExistingNodes: NC Relays each GCD Type I Probe Distribution Report Note over NewNode,NC,ExistingNodes: GCD Acknowledgement Note over NewNode,NC,ExistingNodes: Relay GCD Acknowledgement Note over NewNode,NC,ExistingNodes: Each node (besides NC) waits for all acknowledgements, and notifies NC When complete (NEXT_LINK_STATE in RR set to Begin PHY Profile) Note over NewNode,NC,ExistingNodes: NC waits for all other nodes to advance next link state to Begin PHY Profile. Note over NewNode,NC,ExistingNodes: Advance to next Link State (in Asynchronous MAPS) (Begin using new BBL) </pre> <p>The sequence diagram illustrates the process of GCD Distribution State. It starts with the New Node broadcasting its new GCD Type I Probe Distribution Report. The NC then relays these reports. Following this, GCD Acknowledgements are exchanged between the New Node and Existing Nodes. Subsequently, Relay GCD Acknowledgements are exchanged. Finally, the New Node waits for all acknowledgements and notifies the NC when complete. The NC then waits for all other nodes to advance their next link state to 'Begin PHY Profile'. This leads to the final step where the system advances to the next Link State (in Asynchronous MAPS) and begins using the new BBL.</p> <p>Figure 3-10. Messages Exchanged during the New Node GCD Distribution State</p> <p>(MoCA 1.0, Figure 3-10. <i>See also</i> MoCA 1.1, Figure 3-12; MoCA 2.0, Figure 8-11)</p>

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	<p>“GCD PHY Profile Transmission from NN and ENs: This message is sent by each node, except NC, to all other nodes (including NC). This report is sent in the form of a Type I Probe Report (Section 3.6.3.2) with RELAY_FLAG = 1 for NC to relay the report to the rest of the nodes in the network. The report informs receiving nodes of the PHY profile that the node wishes to use for broadcast messages and asynchronous MAPs (if the node becomes NC).” (MoCA 1.0, Section 3.6.6.1. <i>See also</i> MoCA 1.1, Section 3.6.6.1, MoCA 2.0, Section 8.3.7)</p>
receiving a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node;	<p>The Accused MoCA Instrumentalities operate to receive a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node as described below.</p> <p>For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that receive a plurality of response signals from the sub-plurality of receiving nodes wherein each response signal includes a bit-loading modulation scheme determined by a corresponding receiving node.</p>

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	<p>The sequence diagram illustrates the exchange of messages between three entities: New Node (NN), NC (Network Coordinator), and Existing Nodes (ENs). The process begins with the NN broadcasting its new GCD Type I Probe Distribution Report. The NC then relays this report to the ENs. Both the NN and ENs send GCD Acknowledgements to the NC. Subsequently, the NN and ENs send Relay GCD Acknowledgements to each other. Finally, the NN waits for all acknowledgements and notifies the NC when complete, setting the NEXT_LINK_STATE in RR to Begin PHY Profile. The NC then waits for all other nodes to advance to the next link state, and both the NN and ENs advance to the next Link State (in Asynchronous MAPS) and begin using the new BBL.</p> <p>Figure 3-10. Messages Exchanged during the New Node GCD Distribution State (MoCA 1.0, Figure 3-10. See also MoCA 1.1, Figure 3-12; MoCA 2.0, Figure 8-11)</p> <p>“Following the Type I Probe Report from the NN and ENs, the NC MUST relay the report to the other nodes in the network. The NC MUST NOT change the Type I Probe Report payload when relaying the information.” (MoCA 1.0, Section 3.6.6.2. See also MoCA 1.1, Section 3.6.6.2, MoCA 2.0, Section 8.3.7)</p> <p>“Each node, upon receiving GCD Distribution report from another node, MUST send this acknowledgement to the sender node (relayed via the NC). Also, each node MUST start reporting “Begin PHY Profile” state in its reservation request</p>

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	<p>after it has received the acknowledgments and GCD Distribution reports from all other nodes.”</p> <p>(MoCA 1.0, Section 3.6.6.3. <i>See also</i> MoCA 1.1, Section 3.6.6.3, MoCA 2.0, Section 8.3.7)</p> <p>“Once each node begins to send “Begin PHY Profile” state in its reservation request the NC MUST advance the Link Control state to Begin PHY Profile state. When EN’s and NN receive this Link Control state indication, they can begin using newly computed PHY profiles (including transmit power settings) as described in Section 3.13.3.”</p> <p>(MoCA 1.0, Section 3.6.7. <i>See also</i> MoCA 1.1, Section 3.6.7, MoCA 2.0, Section 8.3.9)</p> <p>“The Type I Probe Report conveys critical information about channel conditions such as Modulation Profile and Power Control. The calculated parameters of this report are derived from Type I and optionally from Type III Probes and are described in Table 3-27. These parameters are to be used in future transmissions to the node that sent the report.”</p> <p>(MoCA 1.0, Section 3.13.3.1. <i>See also</i> MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Section 8.3.4.1.7)</p>

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	<p style="text-align: center;">Table 3-27. Type I Probe Report Calculated Parameters</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #cccccc;"> <th style="text-align: center; padding: 2px;">Parameter</th><th style="text-align: center; padding: 2px;">Explanation</th></tr> </thead> <tbody> <tr> <td style="padding: 2px;">PREAMBLE_TYPE</td><td style="padding: 2px;">Preamble Type P3 or P4 (see Section 4.4.2). Selection is based on channel conditions. For MAP elements, this field is Reserved.</td></tr> <tr> <td style="padding: 2px;">BITS_PER_ACMT_SYMBOL</td><td style="padding: 2px;">The total number of bits per ACMT symbol, calculated from the Modulation Profile.</td></tr> <tr> <td style="padding: 2px;">CHANNEL_USABLE</td><td style="padding: 2px;">Defines if the bandwidth passes the Admission Limit (Section 8.1.5) during Admission or Minimum Link Throughput (Section 8.1.6) during LMO.</td></tr> <tr> <td style="padding: 2px;">CP_LENGTH</td><td style="padding: 2px;">Cyclic Prefix length to be used in future unicast transmissions. May also used to calculate the CP length for GCD transmissions.</td></tr> <tr> <td style="padding: 2px;">TPC_BACKOFF_MAJOR</td><td style="padding: 2px;">Outer Loop Power Control backoff</td></tr> <tr> <td style="padding: 2px;">TPC_BACKOFF_MINOR</td><td style="padding: 2px;">Outer Loop Power Control backoff</td></tr> <tr> <td style="padding: 2px;">SC_MOD</td><td style="padding: 2px;">Modulation Profile</td></tr> </tbody> </table> <p style="text-align: center;">(MoCA 1.0, Table 3-27. <i>See also</i> MoCA 1.1, Table 3-33, MoCA 2.0, Table 6-32)</p> <p style="text-align: center;">“The SC_MOD parameter is used to define the Modulation Profiles for both unicast packets and GCD packets. Unicast packet Modulation Profiles are</p>	Parameter	Explanation	PREAMBLE_TYPE	Preamble Type P3 or P4 (see Section 4.4.2). Selection is based on channel conditions. For MAP elements, this field is Reserved.	BITS_PER_ACMT_SYMBOL	The total number of bits per ACMT symbol, calculated from the Modulation Profile.	CHANNEL_USABLE	Defines if the bandwidth passes the Admission Limit (Section 8.1.5) during Admission or Minimum Link Throughput (Section 8.1.6) during LMO.	CP_LENGTH	Cyclic Prefix length to be used in future unicast transmissions. May also used to calculate the CP length for GCD transmissions.	TPC_BACKOFF_MAJOR	Outer Loop Power Control backoff	TPC_BACKOFF_MINOR	Outer Loop Power Control backoff	SC_MOD	Modulation Profile
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	<p>derived from the Type I Probe. GCD Modulation Profiles are derived from Type I Probe Reports obtained from all nodes. Because GCD packets must be received by multiple nodes, the GCD Modulation Profile MUST be selected to support the required PER to all receiving nodes simultaneously.”</p> <p>(MoCA 1.0, Section 3.13.3.1. <i>See also</i> MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Table 6-32)</p>
determining the common bit-loading modulation scheme from the received plurality of response signals;	<p>The Accused MoCA Instrumentalities operate to determine the common bit-loading modulation scheme from the received plurality of response signals as described below.</p> <p>For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that determine the common bit-loading modulation scheme from the received plurality of response signals.</p> <p>“PHY Profile – A set of parameters that defines the modulation between two nodes, including the preamble type, Cyclic Prefix length, Modulation Profile, and transmit power.”</p> <p>(MoCA 1.0, Section 1.2. <i>See also</i> MoCA 1.1, Section 1.2, MoCA 2.0, Section 3)</p> <p>“Broadcast Bit Loading (BBL) – This transmission format is used by each node when transmitting simultaneously to all nodes in the network. The transmission format is derived by each transmitting node to be the common set of transmission parameters based on unicast transmission format from the transmitting node to each other node in the network.”</p> <p>(MoCA 1.0, Section 1.2. <i>See also</i> MoCA 1.1, Section 1.2, MoCA 2.0, Section 3)</p>

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	<p>“Greatest Common Density (GCD) - A modulation format computed by a node for transmission to multiple recipient nodes. For the GCD format, the modulation density used for each subcarrier is chosen to be the greatest possible constellation density that is less than or equal to the constellation density for that subcarrier as reported in the most recent Type I Probe Report the node sent to each of the other nodes in which the node indicated CHANNEL_USABLE = 0x01.” (MoCA 1.0, Section 1.2. <i>See also</i> MoCA 1.1, Section 1.2, MoCA 2.0, Section 3)</p> <p>“In addition to the point-to-point communication, the MoCA protocol supports broadcast and multicast capabilities. When transmitting to multiple devices, a node must find a set of PHY parameters that all the other nodes can receive. Even though two links from a given transmitter may have the same channel capacity, their individual link characteristics may be drastically different. A common set of PHY parameters that both receive nodes can receive may have less capacity. For broadcast and multicast transmissions, a node must calculate a Broadcast Bitloading (BBL) profile for all nodes that may receive the packet from this node.” (MoCA 1.0, Section 2.1.2. <i>See also</i> MoCA 1.1, Section 2.1.2, MoCA 2.0, Section 5.3.1)</p> <p>“A receiving node processes this [Type I: Modulation Profile Probe] to generate a modulation profile of QAM constellations. The modulation profile is transmitted back to the node that generated the probe so that the node knows which modulation profile to select when transmitting to that receiving node (for a description of PHY probe processing by the MAC see Section 3.13).” (MoCA 1.0, Section 4.5.1. <i>See also</i> MoCA 1.1, Section 4.5.1, MoCA 2.0, Section 8.3.4.1.10)</p>

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	<p>“The SC_MOD parameter is used to define the Modulation Profiles for both unicast packets and GCD packets. Unicast packet Modulation Profiles are derived from the Type I Probe. GCD Modulation Profiles are derived from Type I Probe Reports obtained from all nodes. Because GCD packets must be received by multiple nodes, the GCD Modulation Profile MUST be selected to support the required PER to all receiving nodes simultaneously.”</p> <p>(MoCA 1.0, Section 3.13.3.1. <i>See also</i> MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Table 6-32)</p>
receiving the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission;	<p>The Accused MoCA Instrumentalities operate to receive the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission as described below.</p> <p>For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that receive the probe signal at one receiving node of the plurality of receiving nodes through a channel path of transmission.</p> <p>“While it is physically a shared medium, the logical network model is a fully meshed collection of point-to-point links, each with its own unique channel characteristics and channel capacity. MoCA devices use optimized PHY parameters between every point to point link. Each set of optimized PHY parameters is called a PHY Profile. Because each link is unique, it is critical that all nodes know the source and the destination for every transmission.”</p> <p>(MoCA 1.0, Section 2.1.2. <i>See also</i> MoCA 1.1, Section 2.1.2; MoCA 2.0, Section 1.2.2)</p>

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	<p>The sequence diagram illustrates the exchange of messages between three entities: New Node (NN), NC (Network Coordinator), and Existing Nodes (ENs). The process begins with the NN broadcasting its new GCD Type I Probe Distribution Report. The NC then relays this report to the ENs. Both the NN and ENs acknowledge the receipt of the report. The NN waits for acknowledgements from all nodes before notifying the NC. Finally, the NC waits for all nodes to advance to the next link state, which is then initiated by the NC.</p> <pre>sequenceDiagram participant NN as New Node participant NC as NC participant ENs as Existing Nodes NN->>NC: Each node except NC broadcasts its new GCD Type I Probe Distribution Report (for relay by the NC) NC-->>ENs: NC Relays each GCD Type I Probe Distribution Report ENs->>NN: GCD Acknowledgement ENs->>NC: GCD Acknowledgement NN->>NC: Relay GCD Acknowledgement NC-->>NN: Relay GCD Acknowledgement NN->>NC: Each node (besides NC) waits for all acknowledgements, and notifies NC When complete (NEXT_LINK_STATE in RR set to Begin PHY Profile) NC-->>NN: NC waits for all other nodes to advance next link state to Begin PHY Profile. NN-->>NC: Advance to next Link State (in Asynchronous MAPS) (Begin using new BBL)</pre> <p>Figure 3-10. Messages Exchanged during the New Node GCD Distribution State</p> <p>(MoCA 1.0, Figure 3-10. <i>See also</i> MoCA 1.1, Figure 3-12; MoCA 2.0, Figure 8-11)</p> <p>“Following the Type I Probe Report from the NN and ENs, the NC MUST relay the report to the other nodes in the network. The NC MUST NOT change the Type I Probe Report payload when relaying the information.” (MoCA 1.0, Section 3.6.6.2. <i>See also</i> MoCA 1.1, Section 3.6.6.2, MoCA 2.0, Section 8.3.4.1.9)</p>

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	<p>“Each node, upon receiving GCD Distribution report from another node, MUST send this acknowledgement to the sender node (relayed via the NC). Also, each node MUST start reporting “Begin PHY Profile” state in its reservation request after it has received the acknowledgments and GCD Distribution reports from all other nodes.”</p> <p>(MoCA 1.0, Section 3.6.6.3. <i>See also</i> MoCA 1.1, Section 3.6.6.3, MoCA 2.0, Section 8.3.4.1.10)</p> <p>“The topology of the in-home coax typically results in a multi-path delay profile. Because the echoes can be stronger and/or weaker than the original signal, depending on the output port-to-output port isolation of the jumped splitter, the channel is said to have either pre- or post-echoes, respectively. A zero decibel echo, i.e., equal power to the main path, leads to deep nulls in the frequency domain spectrum. In order to achieve target packet error rates of less than 10-5 for large packets (>1500 bytes) with no retransmissions, the MoCA physical layer uses channel pre-equalization (using bit loading) and multi-tone modulation on all links.”</p> <p>(MoCA 1.0, Section 2.2. <i>See also</i> MoCA 1.1, Section 2.2; MoCA 2.0, Section 5.2)</p> <p>“ACMT is a variation of orthogonal frequency division multiplexing (OFDM) where knowledge of the channel is used to pre-equalize all signals using variable bitloading on all subcarriers. The term used to describe the bitloading of the ACMT subcarriers is “modulation profile” and the process of creating a modulation profile between a node pair is called “modulation profiling”. During periodic modulation profiling, probes are sent between all nodes and analyzed. After probe analysis, modulation profiles are chosen to optimize individual link</p>

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	<p>throughput while maintaining a low packet error rate.”</p> <p>(MoCA 1.0, Section 2.2. <i>See also</i> MoCA 1.1, Section 2.2; MoCA 2.0, Section 5)</p> <p>“A variety of physical layer frequency-domain and time-domain probes are used to create modulation profiles, optimize performance, and allow for various calibration mechanisms. Type I Modulation Profile Probes are frequency domain probes used to determine modulation profiles of the channel between any two nodes. Type II Probes are frequency domain probes consisting of two tones that may be used to fine tune performance. A Type III Echo Profile Probe may be used to determine the impulse response of the channel. This information can be used to optimize various physical layer parameters. In addition to the above probes, this specification provides opportunities for various unique Loopback Transmissions which may be useful for RF calibration, among other things.”</p> <p>(MoCA 1.0, Section 2.2. <i>See also</i> MoCA 1.1, Section 2.2; MoCA 2.0, Section 5.2)</p>
determining the transmission characteristics of the channel path at the one receiving node;	<p>The Accused MoCA Instrumentalities operate to determine the transmission characteristics of the channel path at the one receiving node as described below.</p> <p>For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that determine the transmission characteristics of the channel path at the one receiving node.</p> <p>“The logical network model is significantly different than the physical network. Because of the effects of splitter jumping and reflections, the channel</p>

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	<p>characteristics for a link between two nodes may be dramatically different than a link between any other two nodes. Channel characteristics are also sensitive to the direction of the communication, so a reverse path may be different than the forward path.”</p> <p>(MoCA 1.0, Section 2.1.2. <i>See also</i> MoCA 1.1, Section 2.1.2, MoCA 2.0, Section 1.2.2)</p> <p>“In addition to the point-to-point communication, the MoCA protocol supports broadcast and multicast capabilities. When transmitting to multiple devices, a node must find a set of PHY parameters that all the other nodes can receive. Even though two links from a given transmitter may have the same channel capacity, their individual link characteristics may be drastically different. A common set of PHY parameters that both receive nodes can receive may have less capacity. For broadcast and multicast transmissions, a node must calculate a Broadcast Bitloading (BBL) profile for all nodes that may receive the packet from this node.</p> <p>(MoCA 1.0, Section 2.1.2. <i>See also</i> MoCA 1.1, Section 2.1.2, MoCA 2.0, Section 5.3.1)</p> <p>“The PHY packets are categorized into two types as shown in Table 4-1. PHY data packets transport MAC data frames (e.g. containing application layer data and MoCA Network control data). PHY probe packets transport information used to characterize the communication medium and optimize physical layer performance.”</p> <p>(MoCA 1.0, Section 4.2. <i>See also</i> MoCA 1.1, Section 4.2, MoCA 2.0, Section 14.2.2.1)</p>
transmitting a response signal from the one receiving node to the transmitting node,	The Accused MoCA Instrumentalities operate to transmit a response signal from the one receiving node to the transmitting node as described below.

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	<p>For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that transmit a response signal from the one receiving node to the transmitting node.</p> <p>“Each node, upon receiving GCD Distribution report from another node, MUST send this acknowledgement to the sender node (relayed via the NC). Also, each node MUST start reporting “Begin PHY Profile” state in its reservation request after it has received the acknowledgments and GCD Distribution reports from all other nodes.”</p> <p>(MoCA 1.0, Section 3.6.6.3. <i>See also</i> MoCA 1.1, Section 3.6.6.3, MoCA 2.0, Section 8.3.7)</p>
wherein the transmission characteristics of the channel path are determined by measuring the bit-error rate (“BER”) characteristics of the received probe signal at the one receiving node and	<p>The transmission characteristics of the channel path are determined by measuring the bit-error rate (“BER”) characteristics of the received probe signal at the one receiving node as described below.</p> <p>For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that determine the transmission characteristics of the channel path by measuring the bit-error rate (“BER”) characteristics of the received probe signal at the one receiving node.</p> <p>“The topology of the in-home coax typically results in a multi-path delay profile. Because the echoes can be stronger and/or weaker than the original signal, depending on the output port-to-output port isolation of the jumped splitter, the channel is said to have either pre- or post-echoes, respectively. A zero decibel echo, i.e., equal power to the main path, leads to deep nulls in the</p>

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	<p>frequency domain spectrum. In order to achieve target packet error rates of less than 10-5 for large packets (>1500 bytes) with no retransmissions, the MoCA physical layer uses channel pre-equalization (using bit loading) and multi-tone modulation on all links.”</p> <p>(MoCA 1.0, Section 2.2. <i>See also</i> MoCA 1.1, Section 2.2; MoCA 2.0, Section 5.2)</p> <p>“The Type I Probe Report conveys critical information about channel conditions such as Modulation Profile and Power Control. The calculated parameters of this report are derived from Type I and optionally from Type III Probes and are described in Table 3-27. These parameters are to be used in future transmissions to the node that sent the report.”</p> <p>(MoCA 1.0, Section 3.13.3.1. <i>See also</i> MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Section 8.3.4.1.7)</p>

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	<p style="text-align: center;">Table 3-27. Type I Probe Report Calculated Parameters</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #cccccc;"> <th style="text-align: center; padding: 2px;">Parameter</th><th style="text-align: center; padding: 2px;">Explanation</th></tr> </thead> <tbody> <tr> <td style="padding: 2px;">PREAMBLE_TYPE</td><td style="padding: 2px;">Preamble Type P3 or P4 (see Section 4.4.2). Selection is based on channel conditions. For MAP elements, this field is Reserved.</td></tr> <tr> <td style="padding: 2px;">BITS_PER_ACMT_SYMBOL</td><td style="padding: 2px;">The total number of bits per ACMT symbol, calculated from the Modulation Profile.</td></tr> <tr> <td style="padding: 2px;">CHANNEL_USABLE</td><td style="padding: 2px;">Defines if the bandwidth passes the Admission Limit (Section 8.1.5) during Admission or Minimum Link Throughput (Section 8.1.6) during LMO.</td></tr> <tr> <td style="padding: 2px;">CP_LENGTH</td><td style="padding: 2px;">Cyclic Prefix length to be used in future unicast transmissions. May also used to calculate the CP length for GCD transmissions.</td></tr> <tr> <td style="padding: 2px;">TPC_BACKOFF_MAJOR</td><td style="padding: 2px;">Outer Loop Power Control backoff</td></tr> <tr> <td style="padding: 2px;">TPC_BACKOFF_MINOR</td><td style="padding: 2px;">Outer Loop Power Control backoff</td></tr> <tr> <td style="padding: 2px;">SC_MOD</td><td style="padding: 2px;">Modulation Profile</td></tr> </tbody> </table> <p>(MoCA 1.0, Table 3-27. <i>See also</i> MoCA 1.1, Table 3-33, MoCA 2.0, Table 6-32)</p> <p>“The SC_MOD parameter is used to define the Modulation Profiles for both unicast packets and GCD packets. Unicast packet Modulation Profiles are</p>	Parameter	Explanation	PREAMBLE_TYPE	Preamble Type P3 or P4 (see Section 4.4.2). Selection is based on channel conditions. For MAP elements, this field is Reserved.	BITS_PER_ACMT_SYMBOL	The total number of bits per ACMT symbol, calculated from the Modulation Profile.	CHANNEL_USABLE	Defines if the bandwidth passes the Admission Limit (Section 8.1.5) during Admission or Minimum Link Throughput (Section 8.1.6) during LMO.	CP_LENGTH	Cyclic Prefix length to be used in future unicast transmissions. May also used to calculate the CP length for GCD transmissions.	TPC_BACKOFF_MAJOR	Outer Loop Power Control backoff	TPC_BACKOFF_MINOR	Outer Loop Power Control backoff	SC_MOD	Modulation Profile
Parameter	Explanation																
PREAMBLE_TYPE	Preamble Type P3 or P4 (see Section 4.4.2). Selection is based on channel conditions. For MAP elements, this field is Reserved.																
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SC_MOD	Modulation Profile																

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	<p>derived from the Type I Probe. GCD Modulation Profiles are derived from Type I Probe Reports obtained from all nodes. Because GCD packets must be received by multiple nodes, the GCD Modulation Profile MUST be selected to support the required PER to all receiving nodes simultaneously.”</p> <p>(MoCA 1.0, Section 3.13.3.1. <i>See also</i> MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Table 6-32)</p> <p><i>See also</i> MoCA 1.0, Section 8; MoCA 1.1, Section 8, MoCA 2.0, Section 16.</p> <p>“Modulation Profiling – The process of optimizing the Modulation Profile of the ACMT signal to achieve a high data rate and low packet error rate for a node to node link.”</p> <p>(MoCA 1.0, Section 1.2. <i>See also</i> MoCA 1.1, Section 1.2, MoCA 2.0, Section 3)</p> <p>“The MoCA physical layer (PHY) utilizes a modulation technique named Adaptive Constellation Multi-tone (ACMT). ACMT is a variation of orthogonal frequency division multiplexing (OFDM) where knowledge of the channel is used to pre-equalize all signals using variable bitloading on all subcarriers. The term used to describe the bitloading of the ACMT subcarriers is “modulation profile” and the process of creating a modulation profile between a node pair is called “modulation profiling”. During periodic modulation profiling, probes are sent between all nodes and analyzed. After probe analysis, modulation profiles are chosen to optimize individual link throughput while maintaining a low packet error rate (PER). For each active ACMT subcarrier, the QAM constellation can vary from 1 to 8 bits per symbol (BPSK through 256QAM). Individual subcarriers can also be turned off. As a result, the number of bits per ACMT symbol varies as a function of the channel path.”</p>

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	<p>(MoCA 1.0, Section 2.2. See also MoCA 1.1, Section 2.2; MoCA 2.0, Section 5)</p> <p>“Packet Error Rate (PER) – The ratio between (1) the total number of Ethernet packets with a destination address associated with the receiving Node received at the transmitting Node’s ECL (total number of transmitted packets) minus the number of Ethernet packets received by the receiving Node from the transmitting Node and forwarded to its ECL with no CRC errors and (2) the total number of transmitted packets, when the total number of transmitted packets is at least 10,000,000”</p> <p>(MoCA 1.0, Section 1.2. <i>See also</i> MoCA 1.1, Section 1.2, MoCA 2.0, Section 3)</p> <p>“The MoCA channel characteristics vary considerably between different existing coax home cabling as well as across different RF channels. Since the MoCA system adapts to the channel characteristics, if a MoCA Network is able to form in a coax network, the network MUST operate with a PER $\leq 10^{-5}$ as long as the delay spread is under 800 nanoseconds and external interference is not present. The PER is measured over a minimum of 10 million total packets.”</p> <p>(MoCA 1.0, Section 8.1.1. <i>See also</i> MoCA 1.1, Section 8.1.1, MoCA 2.0, Section 16.3)</p>
generating the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path,	The Accused MoCA Instrumentalities operate to generate the response signal, wherein the response signal utilizes a bit-loading modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path as described below. <p>For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that generate the response signal, wherein the response signal utilizes a bit-loading</p>

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	<p>modulation scheme that is generated by the one receiving node in response to determining the transmission characteristics of the channel path.</p> <p>“GCD PHY Profile Transmission from NN and ENs: This message is sent by each node, except NC, to all other nodes (including NC). This report is sent in the form of a Type I Probe Report (Section 3.6.3.2) with RELAY_FLAG = 1 for NC to relay the report to the rest of the nodes in the network. The report informs receiving nodes of the PHY profile that the node wishes to use for broadcast messages and asynchronous MAPs (if the node becomes NC).” (MoCA 1.0, Section 3.6.6.1. <i>See also</i> MoCA 1.1, Section 3.6.6.1, MoCA 2.0, Section 8.3.7)</p> <p>“Each node, upon receiving GCD Distribution report from another node, MUST send this acknowledgement to the sender node (relayed via the NC). Also, each node MUST start reporting “Begin PHY Profile” state in its reservation request after it has received the acknowledgments and GCD Distribution reports from all other nodes.” (MoCA 1.0, Section 3.6.6.3. <i>See also</i> MoCA 1.1, Section 3.6.6.3, MoCA 2.0, Section 8.3.7)</p> <p>“Once each node begins to send “Begin PHY Profile” state in its reservation request the NC MUST advance the Link Control state to Begin PHY Profile state. When EN’s and NN receive this Link Control state indication, they can begin using newly computed PHY profiles (including transmit power settings) as described in Section 3.13.3.” (MoCA 1.0, Section 3.6.7. <i>See also</i> MoCA 1.1, Section 3.6.7, MoCA 2.0, Section 8.3.9)</p>

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<p>wherein determining a common bit-loading modulation scheme includes: comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.</p>	<p>Determining a common bit-loading modulation scheme includes comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes as described below.</p> <p>For example, by virtue of their compliance with MoCA, the Accused MoCA Instrumentalities include circuitry and/or associated software modules that determine a common bit-loading modulation scheme by at least comparing a plurality of bit-loading modulation schemes from the corresponding received plurality of response signals; and determining the common bit-loading modulation scheme in response to comparing the plurality of bit-loaded modulation schemes.</p> <p>“PHY Profile – A set of parameters that defines the modulation between two nodes, including the preamble type, Cyclic Prefix length, Modulation Profile, and transmit power.” (MoCA 1.0, Section 1.2. <i>See also</i> MoCA 1.1, Section 1.2, MoCA 2.0, Section 3)</p> <p>“Broadcast Bit Loading (BBL) – This transmission format is used by each node when transmitting simultaneously to all nodes in the network. The transmission format is derived by each transmitting node to be the common set of transmission parameters based on unicast transmission format from the transmitting node to each other node in the network.” (MoCA 1.0, Section 1.2. <i>See also</i> MoCA 1.1, Section 1.2, MoCA 2.0, Section 3)</p>

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	<p>“Greatest Common Density (GCD) - A modulation format computed by a node for transmission to multiple recipient nodes. For the GCD format, the modulation density used for each subcarrier is chosen to be the greatest possible constellation density that is less than or equal to the constellation density for that subcarrier as reported in the most recent Type I Probe Report the node sent to each of the other nodes in which the node indicated CHANNEL_USABLE = 0x01.” (MoCA 1.0, Section 1.2. <i>See also</i> MoCA 1.1, Section 1.2, MoCA 2.0, Section 3)</p> <p>“In addition to the point-to-point communication, the MoCA protocol supports broadcast and multicast capabilities. When transmitting to multiple devices, a node must find a set of PHY parameters that all the other nodes can receive. Even though two links from a given transmitter may have the same channel capacity, their individual link characteristics may be drastically different. A common set of PHY parameters that both receive nodes can receive may have less capacity. For broadcast and multicast transmissions, a node must calculate a Broadcast Bitloading (BBL) profile for all nodes that may receive the packet from this node.” (MoCA 1.0, Section 2.1.2. <i>See also</i> MoCA 1.1, Section 2.1.2, MoCA 2.0, Section 5.3.1)</p> <p>“A receiving node processes this [Type I: Modulation Profile Probe] to generate a modulation profile of QAM constellations. The modulation profile is transmitted back to the node that generated the probe so that the node knows which modulation profile to select when transmitting to that receiving node (for a description of PHY probe processing by the MAC see Section 3.13).” (MoCA 1.0, Section 4.5.1. <i>See also</i> MoCA 1.1, Section 4.5.1, MoCA 2.0, Section 8.3.4.1.10)</p>

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	<p>“The SC_MOD parameter is used to define the Modulation Profiles for both unicast packets and GCD packets. Unicast packet Modulation Profiles are derived from the Type I Probe. GCD Modulation Profiles are derived from Type I Probe Reports obtained from all nodes. Because GCD packets must be received by multiple nodes, the GCD Modulation Profile MUST be selected to support the required PER to all receiving nodes simultaneously.”</p> <p>(MoCA 1.0, Section 3.13.3.1. <i>See also</i> MoCA 1.1, Section 3.13.3.1, MoCA 2.0, Table 6-32)</p>